

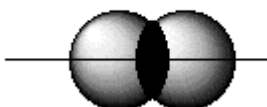
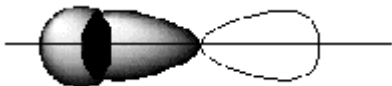


Molecular Geometry, using Orbital Hybridization

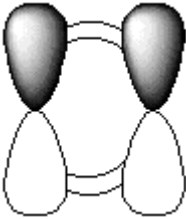
These notes should not replace the reading of good text books.


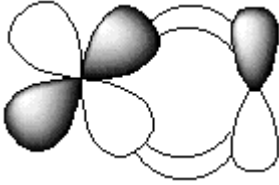
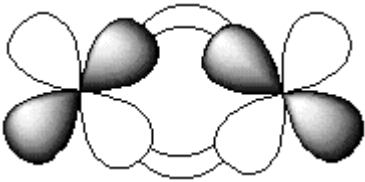
The basis for the Valence Bond theory: Sigma (σ) bonds form by head on overlap of unhybridized, s-orbital-s-orbital, p-orbital-p-orbital, s-orbital-p-orbital and hybridized, (sp , sp^2 , sp^3 , sp^3d and sp^3d^2) orbitals, strong bonds will form.

pi (π)-bonds form by side-ways overlap of unhybridized p- and d-orbitals, weak bonds will form.


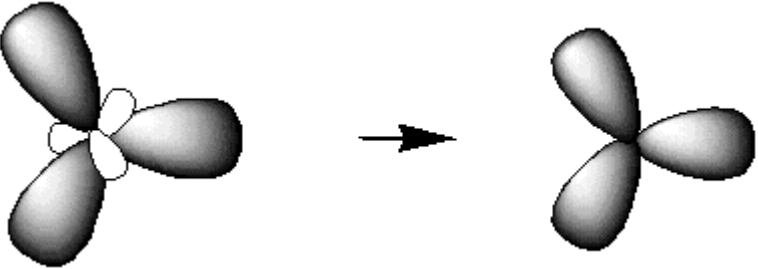
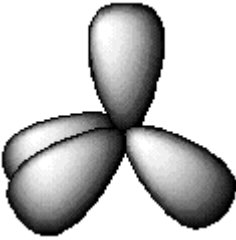
Molecular Geometry (three dimensional structure) can be determined by the number of σ -bonds and the lone pairs on the central atom. These lone pairs will also be accommodated in hybridized orbitals.

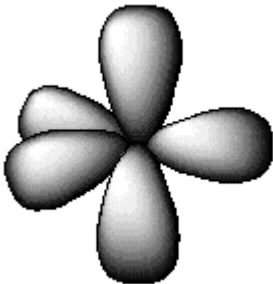
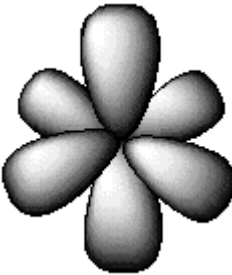
Orbitals used in bond formation	σ -bond, showing the head on overlap of atomic orbitals
s-orbital - s-orbital	
s-orbital - p-orbital	
p-orbital - p-orbital	
sp-hybrid orbital - sp-hybrid orbital or sp-hybrid - sp^2 hybrid or sp^2 hybrid - sp^2 hybrid or sp^2 hybrid - sp^3 hybrid or sp^2 hybrid - sp^3d hybrid or sp^3 hybrid - sp^3d^2 hybrid and so on	 Two overlapping hybrids, forming a strong bond Hybridized orbitals will be simplified like so

Orbitals used in bond formation	π -bond, showing the side-ways overlap of atomic orbitals
p_y -orbital - p_y -orbital	 overlap also illustrated like

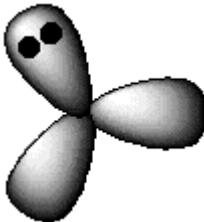
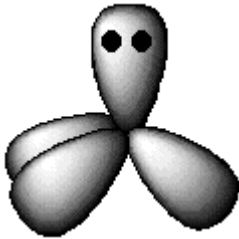
	
$3d_{xy}$ -orbital - p_y -orbital	
$3d_{xy}$ -orbital - $3d_{xy}$ -orbital	

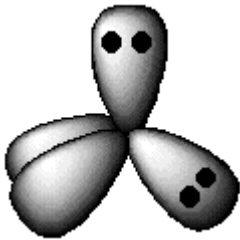
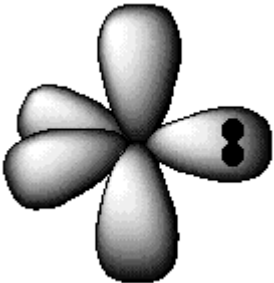
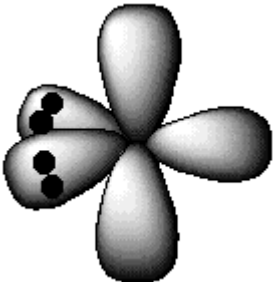
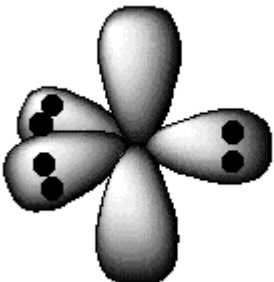
Hybridization and associated Molecular Geometry

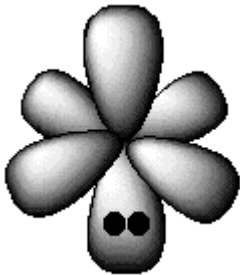
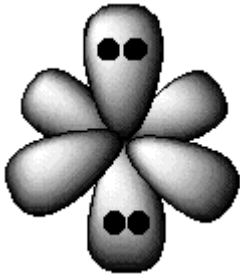
Hybridization	Orbitals (simplified)	Molecular Geometry
sp	 one s + one p :: two sp hybrids	Linear
sp^2	 one s + two p's :: 3 sp^2 hybrids	Trigonal Planar
sp^3	 one s + three p's :: 4 sp^3 hybrids	Tetrahedral

sp^3d	 <p>one s + three p's + one d :: 5 sp^3d hybrids</p>	Trigonal Bipyramidal
sp^3d^2	 <p>one s + three p's + two d's :: 6 sp^3d^2 hybrids</p>	Octahedral

Hybridization, Lone Pairs and associated Molecular Geometry
Molecular Geometry is determined by the positions of atomic nuclei in three dimensional space

Hybridization	Orbitals with LOne Pairs	Molecular Geometry
sp^2	 <p>One Lone Pair in one of the sp^2 hybrids</p>	Bent
sp^3	 <p>One Lone Pair in one of the sp^3 hybrids</p>	Trigonal Pyramidal

sp^3	 <p>Two Lone Pairs in two of the sp^3 hybrids</p>	Bent
sp^3d	 <p>One Lone Pair in one of the sp^3d hybrids</p>	See Saw
sp^3d	 <p>Two Lone Pairs in two of the sp^3d hybrids</p>	T-Structure
sp^3d	 <p>Three Lone Pairs in three of the sp^3d hybrids</p>	Linear

sp^3d^2	 <p>One Lone Pair in one of the sp^3d^2 hybrids</p>	Square-pyramidal
sp^3d^2	 <p>Two Lone Pairs in two of the sp^3d^2 hybrids</p>	Square-planar



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